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Determining Factors of ERP Assimilation: Exploratory Findings from a Developed and a Developing Country

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Abstract. ERP systems gained a worldwide popularity as the software application that would improve the businesses' efficiency and productivity and streamline their operations. Realizing these benefits however depends on the deep and extensive assimilation of the system in the organization. Research about ERP post-implementation and ERP assimilation however is very limited. Similarly, scant research investigated EPR experiences in developing countries. Based on a qualitative research methodology grounded in the diffusion of innovations theory, the present research aims at investigating the factors that would promote EPR assimilation. A comparative case study analysis of six firms in a developed and a developing country suggest that in both contexts, the primary factor for supporting and encouraging a successful ERP assimilation. Other factors such as training and education, IT support, organizational culture, managers and users involvement and strategic alignment were also identified as factors that foster ERP assimilation. Our results also emphasize the need to watch for and to carefully manage factors that could hamper the proper ERP assimilation.

Keywords. Enterprise resource planning, ERP systems, assimilation, post-implementation, case study, developing country, manufacturing organisations.

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1. Introduction

Enterprise resource planning (ERP) systems are multi-module off the shelf software suites that seek to integrate and optimize a firm's information flow, business processes, functions and to provide data in real-time (Law and Ngai, 2007). Lured by the numerous advantages of ERP systems and with their ability to deliver competitive advantage, companies worldwide have substantially invested in ERP applications. According to the consulting firm ARC Advisory Group, worldwide ERP investments are projected to reach $25 billion by 2011 (HIS, 2007). In spite of the large investments in ERPs, the relatively long experience with these systems and the accumulated knowledge about ERP projects, few firms are efficiently using their system. Surveys about ERP deployment level reported that only 50 to 75 percent of the fun ions are deployed (Yu, 2005). Another study reported that among 117 firms, while 20 percent of the projects are terminated before installation completion, half of the remaining 80 percent were not able to realize their business objectives (Yu, 2005). There have been also studies that reported that there were also cases initial implementation failure which transformed years into success yielding significant benefits for the business (Jasperson et al., 2005).

Completing the system's implementation is in fact not the end of the ERP journey. Like other complex information technologies, once the system is installed, the adopting organization needs to ensure the effective assimilation of the ERP in order to be able to reap the latter's benefits (Chatterjee et al., 2002). Effective Assimilation is achieved when the system's ownership among employees is high and when it becomes institutionalized in the organization's work processes and efficiently deployed at the different levels of managerial activities (Botta-Genoulaz and Millet, 2005, Carton and Adam, 2005, Cooper and Zmud, 1990). Recent ERP research reviews (Yu, 2005, Botta-Genoulaz, 2005, Ifinedo, 2008) showed that there has been an abundance in research studies about the early ERP project stages, namely the evaluation and selection of software/vendor/ consultants and the implementation including subjects such as implementation methodologies, key factors for successful adoption and implementation, and potential issues problems that may arise during ERP implementation. Even though these subjects are of considerable importance for EPR success, studying the post-implementation stage issues is an imperative for ensuring long term system success. Extending knowledge about ERP post-implementation is therefore imperative. In spite of the recent tendency to study the post-implementation stage-issues, there is still a considerable dearth in research in this field (Yu, 2005, Botta-Genoulaz, 2005). More precisely, there is a lack of a solid theoretical framework for identifying the determinants that improve the assimilation process of ERP systems in firms. A first objective of this research is therefore to investigate the factors that could explain why some firms are more successful in assimilating their systems than others. The first research question is therefore: What determinants could explain the variation in ERP assimilation among firms? By identifying these factors, firms would have a better idea about which issues should be taken into consideration in order to improve system deployment and increase the chances of achieving the promised ERP benefits.

A second objective of this research is to investigate whether the impact of these factors differs between a developed and a developing country by answering the following

question: How does the impact of these factors vary in the case of a developed *versus* a developing country?

In fact, prior ERP research predominantly focused on the North American context (the United Sates in particular) and to a lesser extent the Western European application context. Scant studies dealt with the developing countries context (Ngai et al., 2008) in spite of the valuable lessons that could be learned from their experiences. Developed countries, such as USA, Canada and some western European countries have long been the major adopters of ERP systems (Huang and Palvia, 2001). However, the ERP market in developing countries has been also considerably expanding. For instance, according to IDC, a market research and analysis firm, Middle Eastern and North African countries, has been escalating reaching $206 Million in 2006, representing an increase of 33% (IT Facts, 2007). Since the vendors of the largely used ERP brands originate in Europe and North America, these two regions' business practices as well as the vendor's norms and values are very likely to be replicated in the ERP's embedded business modules (Sheu et al., 2004). Previous research showed that when implemented in other countries with different culture, economic conditions, government regulations, management style, and labor skills, several problems could arise. These problems are often related to the misalignment between ERP features and organizational requirements, cultural differences, integration issues and the level of economic development of various countries (e.g. Soh et al., 2000, Davison, 2002, Huang and Palvia, 2001, Rajapakse and Seddon, 2005). Additional efforts are therefore required to better understand ERP projects in developing countries. Since most of ERP research in developing countries was realized in Asian countries, mainly China, we opted for a country of the unexplored North African region. Therefore, for illustrative purposes, we chose Tunisia as a developing country and Canada as a developed country.

In spite of its small size, Tunisia has transformed itself into a newly industrialized and open economy and has been in parallel dynamically developing its information technology (IT) infrastructure (Yagoubi, 2004, FIPA-Tunisia, 2007a). The Tunisian economy is essentially composed of SME with the manufacturing sector representing about 20% of the GDP (FIPA-Tunisia, 2007b). Since the signature of the Free trade agreement with the European Union in 1995 to remove tariff and other trade barriers on the majority of consumer goods by 2008, manufacturing firms had the burden of improving their products and services quality, flexibility, reliability and speed in order to be able to compete with firms in more advanced countries (Yagoubi, 2004). It is also worth noting that about 47% of the manufacturing companies are totally exporting (Industry Promotion Agency 2008) and are mainly dealing with western European partners. Among other things, these firms had to modernize their technologies and to upgrade their management and production methods and practices. In order to improve their effectiveness and flexibility, several Tunisian firms adopted technologies such as computer aided design, and computer aided manufacturing systems and ERP. Since 1997, many subsidiaries of multinational companies were forced to implement the system in response to the requirements of their partners/headquarters. Subsequently, with the establishment of major ERP vendors representatives established themselves in the country (e/g. SAP and Oracle in 1998), more and more companies, large and SME, recognized the advantages of these systems and their importance for their long term survival.

This paper is organized as follows. First we provide an account of the theoretical foundations of the concept of assimilation. Next we present the theoretical framework that guided our empirical research followed by a description of our methodology. Section 5 provides a brief description of the participating companies. The cases analysis and research findings are presented in section 6. At last, we offer some concluding thoughts.

2. Theoretical foundation

The diffusion of innovation theory represents our primary approach to study the assimilation process. Roger's diffusion of innovation theory posits that the perceived attributes of the innovation and the firm's characteristics (mainly centralization, size, slack, formalization, and interconnectedness) influence the adoption and use of an innovation (Rogers, 1995). Although it seems to be quite appropriate to study innovation use, Roger's model has been criticized of being mainly adaptable to simple technological innovations requiring individual decision making. More research has, therefore, been made, based on Roger's theory, to better explain the diffusion of complex technological innovations. For instance, Tornatzky and Feleischer's (1990) model considers three aspects of the firm's context that influence a complex innovation's adoption and assimilation process. The three groups of contextual factors, also denoted as TOE, are: technological, organizational, and environmental. The additional environment category is an important component in the model as it could present both constraints and opportunities to its operations (Tornatzky and Feleischer, 1990). The firm's environment includes its industry, its partners and competitors, its partners, external resources, government as well as any other direct or indirect source of pressures or motivations that could impact its operations. The organizational context organizational context describes measures such quality of its human resources, size and scope, the centralization and formalization and the amount of slack resources. The technological context considers the internal and external technological resources that are available for the firm. The TOE has been used in several studies to examine the adoption and implementation of several IS applications including technologies proved to be empirically appropriate and useful for studying complex innovations (Zhu et al., 2004) including ERP systems (e.g. Bradford and Florin, 2003). The relevance of contingency factors, including organizational, technological and external factors, for ERP implementation and benefits realization have been significantly stressed by several researchers.

ERP systems are packaged software embedding in their basic architecture business knowledge and business process reference models also called "best practices" (Srivardhanaa and Pawlowski, 2007). They bring in also the knowledge and expertise of implementation partners (Srivardhanaa and Pawlowski, 2007). All this knowledge, which evolves and increases with each upgrade, needs to be properly understood and applied in order to support business analysis and decision making (Shang and Hsu, 2007). It has been in fact argued that most technologies exhibit an assimilation gap defined as the condition where organizational assimilation and use lags far behind organizational adoption (Fichman and Kemereer, 1999). Moreover, there has been evidence that the functional potential of IT applications is being underutilized in organizations and that they are not being properly used. Usage is often limited to low level features and

technology related extension of the available features are rarely initiated (Shang and Hsu, 2007).

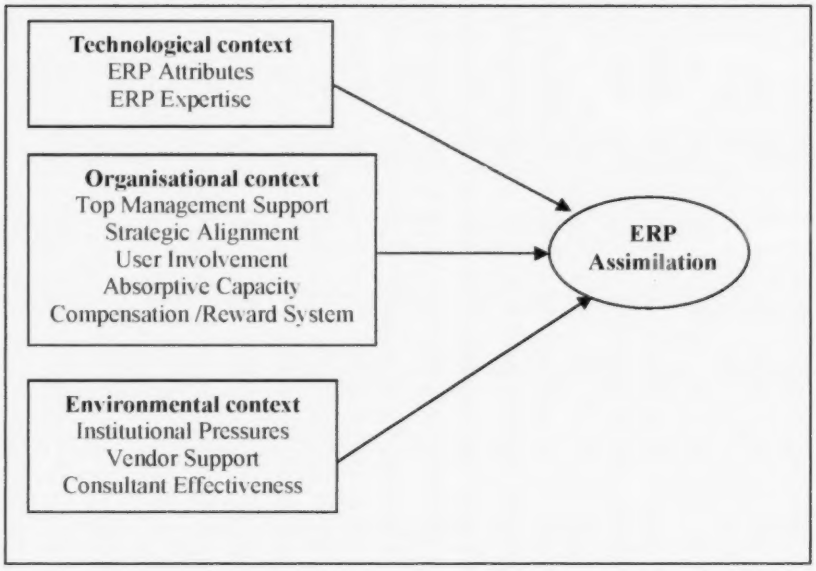
In their diffusion stage model, Copper and Zmud (1990) identify six stages for IT projects, three of which denote the post-implementation phase. These are: acceptance, routinization and infusion. During the acceptance stage, users are incited (mandated) to commit to the system use. During routinization, the technology's use is no longer considered to be out of ordinary and becomes part of the work routines. Its use is sustained and becomes repetitive and spontaneous. Beyond routinization -i.e. during the infusion stage- the system becomes deeply and comprehensively embedded in the organization's work system and value chain (infusion). The firm would opt at this stage to further integrate the system and extend its functionalities by adding new modules or applications to support new activities and to reach external partners (Muscatello and Parente, 2006). With the accumulated learning and experience, users should be encouraged to move beyond the basic system features and to use more of use of the system functionalities to support more (sophisticated) tasks (Hsieh and Zmud, 2006) Users at this stage could even extend the system features and try to explore and to innovate with the technology therefore supporting tasks that were not recognized by the designer prior to the implementation of the system (Jasperson et al., 2005, Hsieh and Zmud, 2006) use of the system functionalities to support more (sophisticated) tasks. Botta-Genoulaz and Millet (2005) suggest three level of ERP use: an operational stage where the system is mastered to control the exiting data; a second tactical stage where the system is used to better control the firm's operational processes; a final strategic stage where the system is used to support the firm's strategy.

For the purpose of this research, we define assimilation as the extent to which the system is diffused and institutionalized in the organization's work processes and managerial activities namely operational control, management (tactical) control and strategic planning.

3. Research Framework

Drawing on the ERP implementation and IS assimilation literature, we focused on factors within the three main contexts that could influence the ERP assimilation process: the technological context factors, the organizational context factors, and the environmental context factors. The following figure illustrates the research framework that guided our empirical investigation framework. Since our research was primarily exploratory, we chose to not specify any formal hypothesis that could act as an impediment to discover important insights and new dimensions while realizing the research.

Figure 1 Research framework (Adapted from Kouki et al, 2007, forthcoming)



This framework postulates that the presence of three sets of critical success factors, namely organization-related, technology–related and environment-related success factors will result into an efficient assimilation of the ERP system. Similarly, overlooking these factors will cause the inefficient assimilation of the system. The inefficient assimilation of the ERP system would lead to an ineffective system and could even cause the failure and the abandonment of the system.

4. Methodology

We have adopted in this research the in-depth case study approach (Yin, 2003). This approach has been commonly used in information system research (Myers, 1997). We used this exploratory approach given that little is known about ERP assimilation and the contingency factors that influence this phenomenon in a developed and a developing country. Case study research is also a useful strategy to study a complex phenomenon in its natural setting phenomenon and is appropriate for new topic areas (Yin, 2003, Eisenhardt 1989). Using the case study method enables us to "retain the holistic and meaningful characteristics of real-life events, such as (...) organizational and managerial processes" (Yin 2003, p.2). It has been also argued that the exploratory case study is an appropriate research strategy for theory development (Yin, 2003, Eisenhardt 1989). Unlike the approach where the researcher does not rely on prior theory and where the development of relevant theory, hypotheses, and concepts are a purpose of the project, we adopt the approach where the researcher works with an explicit framework

Nevertheless, we draw in our study on prior theory, diffusion of innovation theory and TOE framework, in addition to ERP implementation and use and IS assimilation literature to identify some of the factors that are relevant to our subject. Data and theory are therefore linked iteratively (Eisenhardt 1989).

We have used the multiple-case study approach in order to increase generality and support to our findings (Yin, 2003). Six manufacturing companies were chosen: 3 in the

Canadian province of Quebec and three in Tunisia. They were all at the post-implementation stage with different levels of success. A case study protocol was developed in order to guide the semi-structured interviews. The protocol was reviewed and pre-tested in three manufacturing companies in order to validate the questions and improve them. At least five managers were interviewed in each company, including the operations/production manager, the marketing manager, the finance/accounting manager, the IT manager and a plant manager. The primary source of data was the in-depth semi structured interviews. Field notes, documents provided by some responds, and archival data such as on-line data, and documents provided by the companies represented other sources of data. These spruces of data enriched the collected data through interviews, and helped in the diversification of the different types of data. The interviews lasted between 40 and 90 minutes. The interviews were tape-recorded, with the prior permission of the interviewee. Respondents talked freely especially after being reassured about the anonymity of the interviews. The interview questions aimed at investigating the relevance and the importance of the suggested factors for the assimilation process and on exploring any extra significant variables. Problems that had been encountered and handicaps that affected the effectiveness of the assimilation process were also identified by the respondents.

In order to ensure the rigor of the study and quality design and findings, we conducted several validity tests as illustrated in the following table.

Table 1 Validity and reliability measures

Test	Approach used
1. Construct validity/ confirmability Ensuring objectivity and limiting bias and subjectivity throughout the research	▪Triangulation using multiple sources of evidence (multiple respondents, tape-recorded interviews, notes, on-line documents, other company documents); verbatim interview transcripts and notes with sufficient citations for the different portions of each case study database; key informants reviewed the case study reports; research assistant reviewed interview transcripts, data analysis and findings
2. Internal validity/ credibility Extent to which causal relationships could be established; ensuring research credibility	▪Within-case analysis; cross-case analysis; cross-nation analysis; pattern matching; cross-checking results with researchers, the research assistant and colleagues
3. External validity/ transferability Ensuring the generalization of the findings	▪Literal and theoretical replication logic for multiple cases across two different countries; comparison with extant literature
4. Reliability/dependability Demonstrating that the operations of a study can be repeated with the same results	▪Interview protocol; tape-recording the interviews; maintaining a database of findings and collected data; multiple researchers; key informants reviewed the case study report; researchers and colleagues reviewed data analysis and conclusions

5. Brief companies' backgrounds

5.1 Canadian companies

Company A

Company A is a medium-sized leading food processing company in the province of Quebec. Its products include a variety of cookies and crackers manufactured in 5 facilities in Quebec, Ontario and one in the US. Over the years, the company has experienced sustained growth with sales exceeding $160 million US. The company mainly needed a system that evolves with its requirement, satisfies its clients' pressures, and therefore a system that helps it maintain and improve its competitive position in the market. An ERP system was the appropriate answer to these needs, especially that its adoption came early (in 1997) compared to their competitors in the market. The purpose of choosing SAP among other ERP brands was simply because the decision makers "felt" that it was the right product for them.

Company B

Company B is one of the leading North American producers of plastic products. It serves a wide range of industries and operates in four facilities. It has also a network of sales offices and warehouses in Canada and the United States. The main motivation behind ERP adoption was the need to integrate and standardize the firm's financial data. A motive that justifies also the choice of JD Edwards (JDE) compared to other ERP brands. The choice of that brand was also justified by the low number of people required to support the system and its lower complexity compared to other ERP brands Further more, the aging manufacturing system that was no longer supported by its vendor and the need to integrate the firm's functionalities were other motivations to implement an ERP system in the firm. The system went live in the first plant in December 2004.

Company C

Company C is a division of a North American leading pulp, paper and forest products company. The wood division operations include the manufacturing, marketing and distribution of lumber and wood-based value-added products both in Canada and the United Sates. In addition to a remanufacturing facility, and due to a number of economic difficulties including the high timber costs, the lower demand for lumber and wood chips as well the Canadian dollar fluctuations, Company C is currently operating in just five of its eleven sawmills. Two main factors motivated the ERP implementation in 2002. The company needed to standardize its financial and accounting systems and to have a unique database for its clients and suppliers. Moreover, with the increasing off-shore competition, Company C realized the need for a system with high potential that would provide it with high flexibility, integration and customer responsiveness and that could help improve its competitiveness and long-term viability.

5.2 Tunisian companies

Company D

Company D belongs to a leading group consisting of three agri-food companies. Company D is the largest dairy in Tunisia. Its operations comprise the production of dairy products including sterilized and fermented milk, curd milk, yogurt as well as dry, condensed and evaporated milk. During the last decade, the company experienced

sustained growth, with over 90 million of sales, mainly through the diversification of its products and the acquisition of another dairy company (hence adding a second plant to its original one). With the increasing competition in the dairy sector, in addition to the consumers' requirements for high quality products, Company D heavily invested in technology in order to sustain its competitive position. Adopting an ERP system appeared to be an optimal solution to face the firm's challenges. The firm needed a system that allows the integration of the firm's data (accounting, inventories, materials management, etc.) and the tracking of costs and that improves the firm's flexibility and visibility. The system's implementation started in 2000 and followed a stepwise approach.

Company E

Company E is a subsidiary of a leading global petrochemical company. Its activities include the production and packaging of lubricants, the storage and distribution of fuels as well as the storage of Liquefied Petroleum Gas (LPG) and Bitumen. With about 400 employees and with its diversified products, Company E is among the leaders in its field in Tunisia with sales exceeding 100 million. The company's first ERP implementation dates back to 1996. The system integrated all of the firm's locations and plants and operations run smoothly at the national level. In 2006, the company's headquarters decided to standardize and harmonize the African region's operations and functions in order to improve the compliance among its subsidiaries, decrease operating and production costs, satisfy and support its growing needs and its strategic changes. The project was also a transitory phase towards a global but more complex and a better performing ERP.

Company F

Company F is one of four companies of a leading group in all types of furniture manufacturing and marketing. Company F manufactures a wide variety of products including wood, melamine, metallic and plastic furniture, kitchens, metallic frameworks and glass transformation for furniture and buildings. The company employs about 1000 employees. Its ten plants' final products are sold to the group's commercializing company. With the falling of trade barriers with the EU and the elimination of taxes, the company needed to improve its productivity as well as the quality of its products. The ERP system was therefore adopted in order to help the company centralize its data, standardize its business processes and track and reduce its costs. The company's system went live in 2000 following a big bang approach.

Table 2 Companies' Profiles

	Company A	*Company B*	*Company C*	**Company D**	*Company E*	*Company F*
Number of Employees	About 500	About 1000	About 2000	About 700	About 400	*About 1000*
Sales million US *(as of 31 Dec.2006)*	More than $160	More than $160	About $280	More than $90	More than $100	More than $48 (in-group sales)
Type of System Used	SAP	JD Edwards (JDE)	SAP	JD Edwards (JDE)	JD Edwards (JDE)	JD Edwards (JDE)
Implementation Date (go-live)	1997	2004	2002	2000	1st : 1996 2nd : 2006	2000
Reason for System Selection	▪Suitable for the firm`s operations ▪"Felt" that SAP was the best solution for them	• Requires less people for support than other brands • Less complicated than other systems • Satisfies the business needs	• Already used for the paper division • Has potential for customer service, accounting, operations, etc.	• Requires less people for support than other brands • Less complicated than other systems • Satisfies the business needs • Suitable for firm size	• System chosen by the headquarters • An intermediate system before moving to a more complex one. • Satisfies the business needs	• Requires less people for support than other brands • Less complicated than other systems • Satisfies the business needs
Motivating factors for Adopting ERP System	• Y2K problem • Clients` pressures • Need for a system that evolves with the firm's requirements • Detailed information for taxation	• Integration of the firm's financial data • Outdated manufacturing system • Need to integrate the firm`s functionalities	• Need to standardize the financial and accounting systems of the division (headquarters and mills) • Need for a system that supports growth	• Centralization of the firm's data • Improving and insuring transparency in the company. • Insuring data traceability	• Part of a wider (pan African) project for business process standardization • Intermediate stage towards a more complex and higher performance system	• Improving productivity with the increased competition • Centralization of the group's data • Standardization of business processes • Cost reduction

6. Case Analysis

In this section each variable of the research framework will be described followed by the research findings of the different case studies. Table 2 provides a summary of the six cases.

6.1 Technological context

6.1.1 ERP attributes

It is strongly acknowledged in innovation literature that innovation attributes such as ease of use, relative advantage, and compatibility have an impact on the technology's diffusion and the level of use of the system (Wu and Wang, 2006, Hsieh and Wang, 2007).

All respondents agreed that the level of complexity decreases over time as users get more and more used to the system. There was however more stress on the system ease of use and conviviality by JDE adopters, namely companies B, D, E and F than SAP adopters, that is companies A and C. For instance, even though company A has been using the system since more than 10 years, the complexity of some of the system functionalities discouraged its use for high level decisions. Also, according to several respondents in companies B, C, E and F, early post-implementation output quality issues such as data accuracy, timeliness, integrity and reliability negatively impacted the level of users' involvement and deployment of the system and encouraged in many cases the use of parallel systems. In spite of the frequent interventions of the IT/ERP experts, many of these issues persisted. The causes were attributed not the system, as several respondents asserted, but rather to the human factor. Many shop floor employees are either reluctant to enter data on time or simply ignore the system (because of lack of training during the early stages of the ERP project, hostility towards technology, rejection of change, lack of understanding of the system's relative advantage) which negatively influenced data quality, its integrity and reliability. The domino effect of the "bad data" negatively affects the system outputs. The frustration that these problems cause leads some decision makers, in Company F for instance, to simply bypass the system and use the traditional methods of work.

6.1.2 IT/ERP Expertise

As users start working with the system and learning about its limits, bugs and problems reports and requests for adjustments and new functions become more rampant during the post-implementation stage (Musaji, 2005). An internal IT/ERP expertise is accordingly very crucial to provide continuous system maintenance, fine tuning and user support (Musaji, 2005, Kumar et al., 2003).

All companies, except for Company E, had an internal ERP team. Company F had also a business unit for each module that identifies the business people's needs and parameterize the system based on the expressed needs. Company E was supported by a virtual multinational ERP team that is responsible of solving the users' problems. Even though, company E's respondents were satisfied with the expertise and the level of support of the help desk; they preferred an on-site ERP team. They argue that the

physical presence of the IT team enables better interaction and understanding of the users' problems. Similarly, respondents in Company C, who had a centre of ERP expertise serving all of the group's divisions, expressed the importance of having an ERP unit dedicated to their needs, especially that the division went through critical times due during the implementation and early post-implementation stages due to the significant resistance of employees towards the system. One major problem that was signaled by respondents in companies B, C, D and F, and that was hampering the system assimilation is the heavy workload and the high turnover rate of ERP experts. The Tunisian companies D and F justified the high turnover rate by the high demand for ERP experts and the external competitive wages of such experts. Respondents at Company F added that the dissatisfaction with the new boss supervising the ERP team, his incompetence in the ERP fields, the lack of trust of the ERP team members in his capabilities, his negligence of their concerns and issues, the lack of recognition and utilization of their talents significantly contributed to the decision of departure of several skilled IT employees. In order to limit the drainage of its experts, and the resulting negative effect on the firm's performance, senior management at Company F motivated its engineers with a significant increase in salary in order to accelerate and improve the deployment of its production module. In fact, before the passing away of Company F's ERP project leader, all those who work on the ERP and the head of the departments met on a weekly basis to brainstorm on the system development and improvements, to exchange experiences and to learn about each departments needs. With the arrival of the new responsible who lacked the ERP competency and who was essentially assigned based on his seniority all of the mentioned activities disappeared and there were no follow-up to the system's problems. This has negatively impacted the level of motivation of his subordinates, who were much better skilled with the system. Consequently, much of the work was to improve the deployment of the existing modules. Evening and night shifts represented a different type of problems for Company A. most of the evening and night workers were less trained then their day colleagues and the ERP team members were mostly available during the day. Efforts were however made in order to provide appropriate support for evening and night shifts but it remained less than what was required. Another critical point that could restrain the ERP assimilation was signaled by respondents at companies B and D is the organizational culture that values products innovations over IT innovations. They argued that the system acceptance and assimilation could have been much easier if their organization's culture valued IT innovations, the IT department and IT objectives and strategies higher.

6.2. Organizational context

6.2.1 Top management support

Top management support has been recognized in ERP literature to be an essential factor for an EPR project (Law and Ngai, 2007). Even though the type and level of support throughout an ERP project stages might vary, this factor remains an important determinant for sustaining and promoting the effective system use (Nah and Delgado, 2006). Several researchers stressed the importance of the financial support for the post-implementation stage to cover costs such as IT infrastructure and ERP upgrades, training and IT and ERP resources. It has been also argued that the top management perceptions

and attitude towards the system could shape the norms and values of the organization to facilitate (or impede) the system assimilation (Chatterjee et al., 2002).

All companies reported that they were receiving the adequate financial support for upgrades and system requirements from senior management. Companies C, E and F, however, found it often difficult to justify the need for the financial support especially that the system's return on investment (ROI) takes longer than other investments. The availability of the financial support, however, does not necessarily reflect the real perceptions of top management about the system's usefulness and value. In Company A, for instance, the CEO was still involved in person in the ERP steering committee to discuss the system developments and the system was always among the firm's top priorities. Similarly, middle managers were generally actively involved in the system's development processes and many took part in the ERP steering committee meetings to exchange experiences and suggest improvements for the system. Top management involvement and support was lower at companies C, D and F. At Company C, the significant lack of involvement of both top management and middle managers during implementation negatively influenced the system buy-in in the company once the system was installed. Resistance was significant and therefore extensive efforts were made to adjust the system and to satisfy the different users' needs. With the huge amounts of money spent on the system during the early project phases and the numerous problems encountered during the early post-implementation, there were no plans to any extensions and upgrades were essentially technical. At Company D, due to the frequent delays and problems experienced after the implementation of each module, top management did not fully trust the system's capabilities and lacked interest and support. Priorities were, furthermore, always given to projects with quicker and tangible returns than those of the ERP system. As a respondent at company B puts it: "*culturally speaking, priority is given to investments in products and not in IT*". Indeed, respondents at companies B, D and F stressed the importance of the role of top management in transforming the organizational culture and in supporting the prevalence of an EPR culture, "a *culture of openness, information sharing, doing work on time, real-time and transparency*". Respondents at Company D stressed also the importance of top management interventions to solve issues such as political conflicts that were hampering the acceptance and assimilation of the system, lack of personnel leading to heavy work overloads depriving users from mastering the system, lack of information sharing and hostility to the "new" system among several users. In spite of the awareness of their top management of the system potential in improving the firm's performance, the lack of policies to encourage or rather imposing the system use negatively impacted the system assimilation. In fact, the operations manager at Company D emphasized that the strategic willingness of effectively assimilating the system to reap its rewards should go hand in hand with an operational willingness. Imposing the system use, strict control of users to prevent them from using parallel system, the relocalization of the employees who produce parallel reports were examples of operational policies suggested by our respondents that top management could apply in order to improve the system assimilation.

6.2.2 Strategic alignment

It has been widely recognized in the literature that alignment gaps between IT systems and business strategies is a chief cause of failing to benefit from the system's potential (Preseley, 2006, Rathman et al., 2005). Researchers in this field seem to agree that major gains are realized when the IT supports, stimulates and enables the firm's strategy (Tallon, 2008). Evaluating the system strategic alignment involves not just the system's support to the firm's strategy but the IT support to the business processes, the IT function status in the company and involvement in business strategy formulation and the management practices the impact alignment (Tallon, 2008, Rathman, et al., 2005).

Companies A and E exhibited the highest level of strategic alignment. The system was highly valued in these firms by both senior and middle managers and was always considered to be an institutional tool for the firm's operational effectiveness. One exception however is the sales manager of Company A who persistently preferred his own methods of work and was never comfortable with the system. The main issue in the remaining companies was the lack of understanding of the system's strategic value that its value goes beyond cutting costs. The situation was improving in Company B with the arrival of the new CEO and the new managers who had an experience with ERP systems. ERP and business staff collaborated better to improve the system deployment and the business vision clearly emphasized the system's importance for the firm to improve its performance. At company C, the system was treated more as an IS project rather than a business project. Even though the system performance was improving, several managers perceived the ERP as a mere replication of their older "good" system. The significant lack of involvement of business people with ERP people and the decision of freezing any further developments in the ERP system by senior management increased the strategic gap. Even though the system was chosen at the origin based on its fit with the firm's strategy, Companies D suffered from significant alignment gaps once the system was implemented. As the company's IT manager puts it, better appreciation of the system potential and alignment gap would be reduced when " *by the realization of the equation: objectives of IS= objectives of Top management*".

One interesting factor that was highlighted by respondents at companies B and F is the reporting relationship of the IT manager and the CEO on the one hand and the IT manager and other department managers on the other hand. A respondent at company D argued that the fact that the IT manager was at the same reporting level as the other departments' managers compromised the execution of his recommendations. In fact, these recommendations were seen as a emanating from a mere peer rather than serious orders from senior management. Moreover, the fact at Company B the IT service was supervised by the finance department reinforced a general perception in the company that the ERP system was to serve primarily the finance department and to tighten the control of the other departments' operations. These negative perceptions negatively impacted the system assimilation level in the company.

Improper communication between business and ERP people was another issue that increased the alignment gaps, such as the case of Company F. Several managers, mainly after the passing away of the first ERP project leader, were reluctant to communicate their needs, mainly those who have been working in the company for a long period of time and who were resistant to any change.

6.2.3 User involvement

Unlike other IS projects, ERP user involvement has been argued to be more beneficial during the post-implementation stage (Wagner and Newell, 2007). Companies must therefore understand how to promote user involvement to ensure long-term ERP assimilation success. According to Wu and Wang (2006), as users gradually learn about the system by experiencing it (experiential learning), they start to understand the system's functionalities and to explore its possibilities and limits. They can therefore better describe their requirements and to ask for adjustments to satisfy their needs (Musaji, 2005). The more they are satisfied with the system, the more they are engaged with it and the higher their level of assimilation is (Wagner and Newell, 2007).

The ERP steering committee at Company A presented a valuable tool for users to get their voice heard. During the committee's regular meetings, users' suggestions were evaluated and classified by priority for evaluation and possible implementation. Over time, and as the system stabilized, users became more satisfied with the system and there no major requests for changes. It was mostly IT savvy users later who were motivated to test and discover the system that made suggestions to improve or modify some aspects of the system. IT respondents at companies B, C, D and F stressed the impact of the users' seniority (number of years spent in the company), even if they were not old, computer literacy and ability to express their needs as elements that significantly impact the level of involvement and commitment with the system. For instance, during the early post-implementation stage there was a general dissatisfaction about the system at some departments and sawmills mainly because of the three above mentioned factors. Significant efforts had to be made therefore in order to better understand the users' needs and problems and to customize the system based on these needs. At Companies D and F, shop floor employees in some plants were reluctant to key in data and considered the act of low importance for their tasks. According to an ERP team member at company F, the education of users plays an important role when it comes to properly articulating and expressing their needs and therefore impacting the level of their engagement and involvement with the system. The fear of being controlled and of sharing information "that was considered to be theirs" was another handicap to getting involved and committing to the system. One important factor that was highlighted by respondents at companies B, C, D, E and F is the level of involvement of managers and its impact on the commitment and involvement of their subordinates with the system. The level of the system's deployment, for instance, at the plants of Company F widely differed depending on the managers' perception of the system's value and their trust in the system. The ERP roll-out units specializing in each module at company F were in fact designed to bridge the gap between the technical ERP experts on one hand and the managers and users on the other hand with the hope of better understanding the latter's' needs, encouraging their involvement and assimilation of the system. At Company B, the arrival of the new managers who had an ERP experience improved the level of collaboration and involvement of users with the ERP. The IT/project manager asserts for instance that it became easier for him to have the approval for freeing the required users fro training or to collaborate in improving the system. At Company D, the IT manager stressed that the fear of change and destabilization among managers discouraged them to get involved and to actively take part in the system improvements and deployment. Likewise, at Company D, the reluctance of middle managers to commit to the system was justified by their "fear

of becoming unnecessary for the firm's functioning". For those who trusted more the system, their limited involvement at Company D was also attributed to the heavy workload of the daily tasks, especially with the fast and exponential growth of the company's operations while limiting the workforce. According to the sales manager, even though they were motivated to better use the system, the lack of time and the daily work deprived them from concentrating on learning and mastering the system. As a solution to the lack of involvement and commitment and their corollaries (parallel systems, double checking, etc.), Company D's IT manager and Company B's operations managers believed that if the system use was imposed by top management, through policies and strict rules, the level of system use and assimilation would considerably improve. At the other extreme of the spectrum, managers at Company E have a very high level of system ownership and commitment to the system. Moreover, brainstorming sessions and meetings to discuss changes and to exchange experiences were common rituals in the company, including its plants. The prevailing organizational culture was one of the main factors that was highlighted by most respondents and that was considered as being a crucial factor that influences the level of involvement of both users and managers and the assimilation level in the company. Respondents in Tunisian companies emphasize the fact that an organization needs to understand the mind-set and the culture behind the ERP system which is based on openness, real time and doing things on time, a culture that differs from what was prevailing in several Tunisian organizations.

6.2.4 Absorptive capacity

Absorptive capacity is the ability to acquire, assimilate (understand and interpret) and exploit external information (Cohen and Levinthal, 1990). Ravichandran (2005) opines that this capacity is influenced by the firm's prior knowledge as well as by its investments to acquire, assimilate and exploit new. In addition to the firm's prior IT and ERP knowledge, tanning, education and communication were argued as being among the most important factors for ERP -post-implementation (Jasperson et al., 2005, Muscatello and Parente, 2006, Willis and Willis-Brown, 2002). Post-implementation training and education allows users to deeply assimilate the system by updating their knowledge, improving their understanding of the system's implications for the organization's processes and of their actions' impact on downstream operations (Jasperson et al., 2005, Nicolaou, 2004). Effective communication between key users, IT/ERP personnel and other external partners improves knowledge exchange and system usage (Nah and Delgado, 2006, Nah et al., 2007).

Among the six companies, just company E had a previous experience with an ERP system; a thing that explains the smooth transition to the high level ERP system and the high level of assimilation of the system. In addition to their high quality help desk, and due to the fact that the system allowed the interaction with a bigger population of users (pan African), Company E users benefited form a wide pool of rich system knowledge. This allowed them to enrich their own use and experiences and to learn about better and more sophisticated uses of the system. Due to their accumulated learning of the system and their long experience with the system, most of the company A's modules were deployed to almost their maximum. Consultants were the major source of knowledge for companies A, B, C, E and F when new modules are to be implemented or assistance is needed concerning interaction between modules (as in the case of Company F). In these

companies, the IT teams had upgraded their ERP knowledge mainly through conferences and on-line user groups where ERP knowledge is shared with the global larger ERP users' community. The issue of the absence of a knowledge management system that captures, and stores the acquired knowledge and experience has been once again highlighted by several interviewees when discussing this point. One other major missing element according to most of the respondents is a post-implementation formal training program. Several respondents, mainly IT managers, expressed the need to update the users' knowledge about the system, its evolving requirements and the repercussions of each user's action on other and on the final system outcome. Companies B, C, D and F were in fact suffering from varying level of redundancy and parallel systems which significantly lowered the system assimilation efficiency. Such a redundancy was essentially attributed to the lack of training and proper communication. At company C for instance, the implementation budget cuts targeted primarily training which caused several post-implementation problems. Company C's IT manager asserted that post-implementation training should be done on a periodic basis "*in order to see how people evolve in their learning and system use and in order to assess the needs of future training or business process improvements...It is very important to sustain training especially during the first years of post-implementation*". New comers, in the case of all the studied companies were informally trained on the job by their colleagues to learn the very basic actions that they had to do in order to realize their work. Some respondents highlighted the negative impact of such informal training on the level of system understanding, assimilation of the system which explains the heavy and recurrent need of the new system users for IT support especially when faced with unexpected problems. As a respondent in Company F pointed out unless new recruits are curious about the system, IT savvy and/or have spare time for trial and error most of them limit themselves to the very basic functionalities that they learned from their colleagues.

6.2.5 Compensation/reward system

There has been evidence that reward strategies such as rewarding the acquisition of new skills, linking compensation to company profits and other strategies promote learning and the institutionalization of favorable behaviors (Jerez-Gómez et al., 2005). In a research evaluating the importance of critical factors across ERP projects' phases, Nah and Delgado (2006) found that ERP team skills and compensation was the most important factor for the post-implementation stage. Kei and Wei, (2008) strongly recommend contingent rewards and praise to foster learning, risk taking, innovation, collaboration and collegial support for ERP success.

None of the studied firms, however, changed their reward system to reward and encourage system use. In some organizations, such as company A, the ERP team members were offered to be eligible for overtime during the implementation stage. During Companies B, C, D and F experienced a high turnover rate of their ERP experts and trained superusers. The high demand for ERP expertise was a common cited problem among the respondents. According to the IT manager at Company *"people find big opportunities somewhere else... ERP opens doors. We're talking about significant increases of advantages for the employee who leaves to work with a consulting company versus being an employee in the company"*. Company F respondents stressed also the relatively low wages of ERP/IT experts significantly contributed to the experts departure

which significantly affected the level of deployment of its ERP modules. As was mentioned in section 6.1.2, after the massive departure of ERP and IT experts, top management decided to increase the engineers' wages to encourage the deployment of its production module. At Company B, the frustration of the ERP/ IT experts with the heavy ERP workload (programming, troubleshooting, reports preparation, parameterization, etc.), the heavy reliance of users on them in addition to other IT tasks pushed many of them to leave the company. Respondents at Company A were proud of the high level of loyalty of their employees, especially the IT/ERP team, which they mainly attributed to the 'family –like' ambiance that prevailed in the company and the "good" wages compared to other companies in the industry. Company E did not also suffer from the impacts of ERP experts' turnover since their support team was multinational and virtual. Like Company A, there were no problems of competencies turnover.

6.3. Environmental context

6.3.1 Institutional pressures

It has been argued that the institutional theory helps in understanding IT diffusion (Salemron and Buenoi, 2006). The institutional theory posits that structural and behavioral changes in companies are influenced not just by the desire for efficiency but also by the need to legitimize itself in its external environment (Benders et al., 2006). DiMaggio and Powell (1983) argue that, with this need to legitimization, mimetic, coercive, and normative pressures influence organizations leading them to become more and more similar, or to a phenomenon called institutional isomorphism. Mimetic forces push the decision maker to mimic the choice of other originations, often the leader, to face uncertainty. Coercive forces are exerted by resource-dominant organizations (such as parent corporations, dominant suppliers and customers) as well as by government regulations and policies and industry and professional associations. Normative pressures are exerted by professional communities and professional standards that could directly or indirectly force the firm to assimilate the system. When studying the impact of these forces in the context of ERP systems, Liang et al. (2007) concluded that these forces, meditated by top management, have an important influence on ERP assimilation during the post-implementation stage.

In all the companies, the desire to improve the internal efficiency and performance and to preserve a leading position in the market was among the main drivers to a better deployment of the system. There were however other few external pressures that were pushing some firms to use the system effectively. After most competitors adopted an ERP system, Company A felt an imminent need to surpass its competitors by not just further deploying the system' functionalities but also by innovating with the system. Moreover, their major clients were also an important coercive pressure to ensure the traceability of the firm's products. The customs requirements for updated and detailed reports were another from of coercive forces that pushed company C to integrate its data and to provide reliable and high quality reports for the government. At Company E, the requirements of the firm's headquarters to master the system and to comply with the other region's divisions' norms of work for a further global integration represented a major pressure for the firm to efficiently use the system. It has been mentioned by the different members of the ERP teams/units that the fact of taking part in ERP conferences, on-line

forums and training sessions motivates them to improve their system deployment. This is in fact a form of normative pressures.

6.3.2 Vendor support

Maintaining a strategic relationship and a lifelong commitment with the vendor is believed as being vital for the ERP adopting firm (Wang et al., 2008, Somers and Nelson, 2004; Chang, 2004). With the rapid technological developments of ERPs and the desire of companies to extend and enhance their systems, continuous investments are required (upgrades, new modules, etc.). Given that the original vendors are knowledgeable about their customers' business, processes, and requirements, they are well equipped to serve the firm's needs. Therefore vendor support, which can include technical assistance, software updates, emergency maintenance, user training and other support services, is judged to be very important for the ERP's success and efficient deployment (Wang et al., 2008, Chang, 2004; Somers and Nelson, 2004).

Many of the interviewed companies in our research did not maintain a strategic relationship with the original vendor. This was the case for companies A, B, C, D and F. In the case of the subsidiary, Company E, there was no direct contact with the vendor as the system was brought in with the group's team who has helped the company install the system. Company F was the sole company that maintained contacts with its initial vendor for updates.

6.3.3 Consultant effectiveness

Consultant effectiveness refers to their competence and expertise in providing various types of assistance to the firm such as knowledge, training, maintenance and technical support and any other type of help that the organization needs (, Wang et al., 2008, Ifinedo, 2008). Even though, the use of consultants has been commonly considered as being essential for the ERP implementation stage, it has been also found that found that this factor is of big importance for the post-implementation stage as well (Plant and Willcocks, 2007, Nah and Delgado, 2006).

Experiences with consulting services differed between our studied companies. Companies A, B and D needed an external expertise intervention when they needed to implement a new module. In the case of Company A, the module vendor provided an expert to install the module, train the ERP team and transfer the necessary knowledge for the module key users. Respondents at company A, stressed the "extreme importance" of the high expertise and good experience of the consultant even during the post-implementation stage since, like in the case of the other implemented modules, the company needs to properly learn about the module and about its different functionalities. Company C did not need any consultants since there were no major upgrades or system extensions. Company F decided to end its contract with its implementation consultants about 5 years after the initial implementation as they found that the consultants support was judged to be not anymore advantageous and lacked innovativeness that could further improve the system deployment in the firm. According to one ERP team member, the consultants' task was limited "*to simply replying to questions (about issues) that had to be very specific (...) even the answers were very abridged and they always referred us to the documentation that we already had before about the system*". That type of support according to the company's ERP team was in fact available for free using the online JDE user communities. A new consulting service was however approached in order to provide

training and technical support for new modules that the company was planning to implement. Training was mostly about the interaction between modules. At company E, respondents opined that even though the virtual help desk is very competent, the presence of the consulting team is essential during the system stabilization. That was in fact not possible because that team had the responsibility of implementing the system in another African site of the group. According to a respondent: "*contacting the (implementation team) while they are in another site does not only disturb them but also slows down the other project but we need these people's support*". They further assert that alter during the post-implementation stage most of the help is provided by the virtual desk.

6.4 Evaluation of assimilation in the studied organizations

The assimilation level varied widely across organizations and within the same country. Company A has the oldest experience with the ERP system. Its system is diffused in all of the firm's departments. The core system capacity is deployed to over 85 %. According to Company A's respondents, the system is deeply embedded in the firm's work routines and it provides almost all of the required information to make decisions. Efforts to improve the system value did not stop since its introduction in 1997 especially after the large adoption of the system in their industry. This was both by deepening the deployment of the functionalities of the already installed modules and by extending the system with new modules. ERP mainly supports operational control and to a lesser extent management control. Strategic and planning decisions, however, were made outside the ERP system, as it was considered to be too complicated.

At company B, the system was at a stabilization stage. Two of the plants were integrated and a project to integrate the third plant was in its way. System deployment was limited to the basic functionalities. Parallel systems use, redundancy dissatisfaction among users and managers and lack of trust in the reliability of the system outputs were however prevailing in the company. Efforts to improve the system deployment were being made especially after the arrival of the new CEO and managers. The system serves the operational control needs while the managerial and planning decisions are taken with other systems. In spite of the issues that were experienced, the system represented a main source of data for the company. Even though the system was satisfying most of the finance department's needs, it was only responding to 30 to 40% of the operations department's requirements. According to the operations manager argued that was because ERP was primarily implemented to standardize and centralize the financial information while hoping that other advantages would be felt in other departments.

At Company C, the system had just recovered from a painful implementation and post-go-live problematic phase. Overall, managers were better satisfied with the system especially after the considerable customization to serve the managers' and users' needs. The operations manager maintained that since they were operating in a traditional, low-tech industry, the system provided the company with a competitive advantage. The ERP was mainly used for the daily operations' decisions. According to the operations manager, the ERP system was mainly useful for operational rather than long-term forecasts and other strategic decisions.

At Company D, the approach used was the phased-by module (also called stepwise) approach. Several modules were implemented but they lacked the complete cross functional integration which hindered the traceability of the products costs. The system

was considered as being a basic source of data for several departments and was believed to serve about 50% of the company needs. In spite of the wide issues discussed in the sections above that were surrounding the ERP initiative, significant efforts were being made by the IT department to stabilize the system, integrate the modules, to improve its deployment.

At Company E, the system was also at a stabilization stage. The transition to the new system was smooth and assimilation was rapidly evolving. The system was diffused in almost all of the company's units and all of the implemented modules were integrated providing therefore the managers with an enterprise wide visibility. The ERP represents the backbone of the company and supports operational control. As the system becomes more stabilized and its outputs become more reliable, the system would be used for managerial control. However, planning and strategic decisions were made outside the system using less complicated software for tat type of decisions.

Finally, at Company F, the level of assimilation widely differed from a department to another and from a plant to another. Since the top management's objective was to control the costs of the company's inputs and outputs, the inventory modules were mastered and very effectively deployed. The main problems however concerned operations and production. The production modules' deployment widely differed depending also on the manager's motivation but also on the product's level of complexity and resource requirements. Even though according to a plant manager that didn't directly impact the level of productivity, it did have an effect on the level of information exchange and traceability of costs as well as on the decisions' quality. The system is diffused in almost all of the company's departments and represents therefore the basic source of information for several departments. Since the passing away of the first project leader, all of the optimization efforts aimed at deepening the deploying the functionalities of the existing modules and there were no extension of the system value by adding new modules.

It is worth noting that several managers praised the fact that ERP improved the time to gather critical information for all level of decision making. However, they stressed the importance of the human being in making decisions and solving problems compared to a system that produces automated decisions. In fact most of the interviewed managers thought of the system as being mostly transactional and as being unsuitable for strategic and planning decisions.

Table 3 summarizes our findings for the six companies by factor.

Table 3 Summary of findings

	Company A	*Company B*	*Company C*	*Company D*	*Company E*	*Company F*
ERP attributes	Flexibility, perceived usefulness, impact of other attributes diminished over time as the employees got used to the system	Reliability, ease of use, accuracy, flexibility, perceived usefulness	Reliability, ease of use, accuracy, flexibility	User friendly, easy to manipulate, embeds a whole culture and mind-set	Reliability, flexibility, perceived usefulness/relative advantage (more advantages than older local system).	Ease of use, perceived usefulness, user friendly, flexibility
IT/ERP expertise	+ Very competent, low turnover, high employee loyalty - Night and evening shifts lack ERP support	+ Very competent, - Heavy workload, high expertise turnover	+ Very competent, centre of expertise serving also other divisions - Heavy workload, high ERP expertise turnover	+ Very competent, - Heavy workload, high ERP expertise turnover	+ Virtual multinational ERP help desk, very competent - Importance of physical presence to properly coach users.	+ ERP team includes programmers for each module+ roll-out units for each module +Very competent team members - the present ERP project leader, lacks expertise and motivation to advance and to improve, high ERP expertise turnover
Top management support and involvement	+ Participates at ERP steering committee meetings, provides the required moral and financial support	+ Provides financial support, willingness to benefit from the system, understanding of the system value for the firm - Lack of operational application of the willingness to assimilate the system. Priority to products innovations with	+Provides financial support - Require ROI justifications for expenditures: often difficult for ERP people) - lack of appropriate understanding of the system value : ERP considered as "another IS software",	+Provides financial support -lack of trust in the system due to its problems, lack of involvement in the project, lack of appropriate understanding of the system value, require ROI justifications for expenditures: often	+Provides financial support, high involvement of local top management, highly ranked in the firm's priorities, continuous follow-up of the system developments	+Provides financial support -lack of involvement in the project, lack of appropriate understanding of the system value, priority to extension and product development projects

		quick tangible benefits	significant lack of involvement	difficult for ERP people)		
Absorptive capacity	+ No previous experience with a similar system but long experience with the present system, training opportunities for IT team, ERP steering committee - no post-implementation training, need for a knowledge management system	+ Training opportunities for IT/ERP team - No previous experience with ERP, basic computer literacy, inappropriate user training and education, need for a knowledge management system	- No previous experience with ERP, basic computer literacy, inappropriate user training and education, informal training by coworkers for new users, need for a knowledge management system	- No previous experience with ERP, basic computer literacy, inappropriate user training and education mainly due to heavy daily workload and the unavailability of users to be trained	+ Successful experience with ERP, meetings of plant manager and subordinates for brainstorming on system immurements, virtual exchanges between managers - No formal post-implementation training, -Importance of physical presence of trainers. -Importance of meetings between managers and superusers	-No previous experience with ERP, inappropriate user training and education, no more meetings for brainstorming and exchange of experiences, importance of computer literacy and level of education of users to better express their needs
Strategic alignment	+ ERP still among the firm's priorities, considered as an institutional tool for the firm's operational effectiveness, regular post-implementation reviews, rejection of the sales manager of the system	+ ERP considered to be among the firm's priorities, clear vision and business strategy that values the ERP as important for the firm's operational effectiveness -Lack of understanding of the system's value among users, post-implementation review of the project	+ERP considered to be among the firm's priorities -Lack of understanding of ERP's strategic value among some managers, no clear vision	-Lack of trust in the system, ERP not considered as a priority, lack of alignment between the IT and the top management objectives, no clear vision linking ERP to the firm's strategy, lack of managers' involvement and commitment to the system	+ERP considered to be among the firm's priorities, considered as an institutional tool for the firm's operational effectiveness, regular post-implementation reviews	- ERP not considered as a priority, lack of alignment between the IT and the top management objectives, no clear vision linking ERP to the firm's strategy, lack of managers' involvement and commitment to the system

		outcomes				
User involvement	+ Operations manager highly involved, ERP steering committee for suggestions and system improvements, sales manager not involved	- Lack of trust in the system capabilities, rejection of the system by several users, use of parallel systems, an employee to double checks outputs using excel + New managers are supportive of the system : free users when needed	- Lack of involvement of several managers and key users, legacy thinking requiring extensive customizations to satisfy users' needs. + Improved system buy-in after modifications and customizations.	- Lack of involvement of several managers and key users: reluctance to apply IT mangers' instructions, fear of sharing information and being controlled, users not properly expressing their needs, resistance to change +Suggestions to modify and improve the system are taken into consideration	+ high involvement of employees and managers, users' suggestions taken into consideration	- Lack of involvement of several managers and key users, users not properly expressing their needs, resistance to change, reluctance of shop-floor employees to sue the system, differing levels of involvement of plant managers impacting the overall productivity
Post-implementation consultant effectiveness	▪ Consulting services provided by module vendor. ▪ Very important for knowledge transfer, training and integration of new modules	▪ Consulting services provided by module vendor ▪ Very Important for knowledge transfer and training	▪ Did not need consultants : no system extensions, no major technical upgrades	▪ Consulting services provided by module vendor ▪ Very Important for knowledge transfer and training	▪ Internal team of consultants (belong to the group) ▪ Permanent availability of support	▪ Ended contract with original consultants ▪ New contract with other consultants to provide training for ERP team about new modules and integration
Institutional pressures	▪ Competitive pressures, improving internal efficiency ▪ Clients' pressures (requirements for traceability), normative and mimetic pressures of other SAP adopters and professionals ▪	▪ Improving internal efficiency ▪ Government (customs) requirements: detailed, high-quality information	▪ Competitive pressures, improving internal efficiency ▪ Government (customs) requirements :detailed, high-quality information	▪ Competitive pressures, improving internal efficiency	▪ Competitive pressures, improving internal efficiency ▪ Coercive pressures of the HQ ▪ Normative pressures (requirements of conformity with the region's subsidiaries)	▪ Competitive pressures, improving internal efficiency

Assimilation	▪ System used for operational control ▪ System data used for management control ▪ System is the firm's backbone ▪ The core of SAP/3 is implemented and deployed ▪ Managers use the system (direct contact) except for the sales manager ▪ New modules to extend and improve the system (e.g. Business Warehouse) ▪ System feeding "cockpits" for each department to group the key performance indicators and other decision-making clues	▪ System used for operational control ▪ Not all modules are implemented ▪ System is the firm's backbone ▪ To be implemented in the remaining plant ▪ End-users mastering the basic functionalities of the system ▪ Managers using the system outputs ▪ System not fully deployed : basic functionalities used ▪ Prevailing parallel system ▪ User resistance	▪ System used for transactional-operational control ▪ System data used for management control ▪ System is the firm's backbone ▪ No projects for extending the system and acquiring new modules ▪ End-users mastering the basic functionalities of the system ▪ System not fully deployed (stabilization stage) ▪ Use of parallel systems	▪ Partial integration of modules ▪ Doesn't allow yet costs traceability ▪ System used for operational control ▪ Mostly ascending information exchanges vs. cross-functional exchanges ▪ Projects for extending the system with additional modules ▪ Working on cross-functional integration ▪ Main source of data System not fully deployed (implementation/ stabilization stage)	• System used for operational control • System integrated at the national and regional level • System outputs used by manages • System data used for managerial control • System not fully deployed (stabilization stage)	▪ Different levels of module deployment depending on the manager's willingness, product complexity ▪ Has a negative impact on information exchange ▪ Lack of data reliability due to the users' lack of involvement ▪ Prevailing parallel systems ▪ User resistance ▪ Strategic vision to deploy the system

7 Discussion

This study primarily aims at exploring the factors that influence ERP assimilation in a developed and a developing country context. In fact the end of the system installation marks the start of set of significant efforts to ensure the appropriate system deployment and infusion in the company. A second objective of this research was to investigate whether the impact of these factors differs between a developed and a developing country. The following is a discussion of our findings.

7.1 What determinants could explain the variation in ERP assimilation among firms?

A first remark is that there is a relative commonality across the studied companies regarding the determining and constraining factors for achieving a high level of ERP assimilation. First this study affirms that regardless of national differences top management support remains is strongly related to effective ERP assimilation. Providing the necessary financial support is necessary but not sufficient to promote assimilation in the company. Top management's knowledge about the system, its potential for the company and its requirements should be regularly reviewed and updated. A clear and effective communication is also necessary between the ERP /IT manager and top management to dispel any resistance, lack of trust in the system, or confusion that could form as a result of the issues of the post-installation stage. One main task of top management is to ensure the continuous alignment of the system with the business vision and strategy and to clearly communicate it in the firm. Alignment would be also improved by integrating the IT function as a potential contributor to business imperatives and consider the system as a valuable strategic resource rather than a cost to minimize and a cost effectiveness tool (Willkocks and Sykes, 2000)

In order to reinforce the commitment of all employees and the effective deployment of the system across the organization, top management should use their authority to resolve the political conflicts and influence the behaviors of both managers and users to encourage, or rather impose the system use. They could also reinforce the policies prohibiting parallel systems and redundant data and a strict control of system use could eliminate deficiencies and force the system deployment for at least the basic users' tasks. As in the case of companies A., assimilation would then progress over time reaching infusion, when more of the system features and functionalities are used to accommodate more tasks (Saga and Zmud, 1994) and system extensions are implemented, by adding new modules, new functionalities, add-ons to enhance the system value.

Another lesson learned from this research is that middle managers involvement and ownership of the system is crucial to encourage system assimilation in their departments (Yu, 2005). It is worth noting that this research showed that in cases where top management are highly supportive of the system, middle managers were also engaged with the system. First, actively involving managers through regular meetings of middle managers with the EPR team to exchange experiences, brainstorm about improvements, extensions, and upgrades, discussing suggestions proved to be a very effective activity to ensure a continuous support and involvement of middle managers. Second, the middle managers positive perception of the system and their support to the system are in fact important especially when it comes to diffusing positive perceptions about the system and its value, empowering their subordinates to accept their (new) enriched tasks and to make the system use part of their routine work, encouraging the innovative and deep

deployment of the system features to satisfy more of their departments needs, freeing resources when required for the system developments and optimization, and encouraging their involvement. Users' involvement during the post-implementation stage was also a valuable ingredient for system acceptance and assimilation. Users actually contribute to stabilizing the system and help creating a viable and practical system for the company (Wagner and Newell, 2006). With their situated practice, users lean more about the system limitations and start suggesting changes and modifications to satisfy their needs. This is mostly during the early post-implementation stage (post-go-live), when users started using the system and discovered the discrepancies between their old and new methods of work. It is, however, crucial that the ERP team listens and considers the users' requirements in order to ensure their acceptance of the system. This could be effectively done through an ERP steering committee, including both the firm ERP experts and the managers that discusses, prioritizes the suggested changes or ERP roll-out units for each module that directly contact the users of the concerned module as in the case of Company F. Failure to satisfy the users' needs and to answer their requests, due to the lack of expertise, overwhelming work of the ERP or inability of users to properly articulate their needs would cause the rejection of the system, leading to the spread parallel systems, redundancy and increased reliance on the old methods of work. Moreover, elements such as the education level, seniority, the IT proficiency, and the openness to change are factors that could moderate the impact of users' involvement.

The above discussion leads us to highlight an important factor that emerged from this research which is the organizational culture. Previous research discussed the importance of this factor for ERP success (Ifinedo, 2007, Nah et al, 2007, Motwani et al., 2002) and the fact that overalls success could be significantly enhanced if there is a match between the system's and the organization's culture (Ifindeo, 2007). ERP assimilation would be higher and easier if the organizational culture values IT and IT strategies and objectives. Our data analysis showed also that open cultures that promote learning, transparency, knowledge and information sharing, cultures that value innovation, collaboration and cooperation are more likely to better assimilate the system than those that lack these characteristics. Our findings stress also the fact that top management have a crucial role in shaping the organizational culture through their actions, interventions and policies to improve the system assimilation. Incentives and rewards for instance could be used to keep users motivated to learn and to be open for sharing knowledge (Al-Mashari et al., 2006). Rewards could include praise for work, promotions and pay increase.

Another important insight is that a skilled and competent internal IT/EPR team is a significantly important factor for the post-implementation stage and for facilitating the system assimilation process (Yu, 2005). The quality of their support and training and their ability to solve the users' problems are essential to promote the users' buy-in and commitment with the system especially during the early post-implementation stage where the risks of technical problems and performance dips are high (Willis and Willis-Brown, 2002). The inadequate resolution of the post-implementation problems along with the lack of knowledge and understanding of top management of the system had, in fact often overshadowed the potential benefits that could be realized once the system is stabilized (Willis and Willis-Brown, 2002). The advantage of an internal ERP team is their good knowledge of the organization's processes, their proximity to workers that enables them to better evaluate the problem and its consequences and the ability of quick and direct

onsite exchanges with users especially in case of an emergency. With the high turnover rate of ERP expertise and the skills shortage, top management should set flexible human resource policies on pay, career, and contracts and provide opportunities for career development (Willkocks and Sykes, 2000). A competent, well experienced and knowledgeable ERP leader would be another important factor to motivate and retain ERP skilled personnel. Providing them with the opportunities to demonstrate their capabilities, to be creative and to learn, listening to their concerns and providing feedback to improve their knowledge and skills.

In particular, the ERP leader should be highly competent, and well about the system and should have a strong leadership that enables him or her to motivate the ERP team and to efficiently guide the firm to progressively extend the value of its system (Willis and Willis-Brown, 2002). Recognizing and using the talents of the other team members and rewarding individual contributions would help retain ERP expertise. Based on our findings, the ERP team had often difficulty to justify the ROI of the ERP upgrade, especially when significant problems were faced during the implementation and early post-implementation. For that reason, they should stress the importance of the numerous business benefits that enhanced system functionality would yield instead of solely using cost savings as the sole motivator of the system upgrade (Beatty and Williams, 2006). Modular add-ons such as Web portals, data warehouses, and customer management systems are but a few examples of extend functionalities. It is worth noting that the effect of ERP complexity fades over time as users become more familiar with the system resulting into a higher level of system deployment and better assimilation. However, issues with the system's output quality such as output reliability, integrity, completeness, timeliness, etc. and the negative and/or unclear perceptions about the system's usefulness and relative advantage were considered as major handicaps to system assimilation. These problems were mainly attributed to the improper training and education during the early stages of the ERP project and the absence of a post-implementation upgrading program.

Indeed, the firm's absorptive capacity proved to be also an important factor for improved system assimilation. First, our data analysis showed the critical value of a formal post-implementation training program is an imperative for improving the system assimilation and for ERP success (Nah and Delgado, 2006), especially in case this activity was overlooked during the implementation stage. A neglect of this component would negatively impacts the level of system assimilation mainly in terms of deep usage and innovativeness with the system. Also, in spite of its immediate advantages such as low cost, informal training by learning from other workers and imitating their work without any theoretical foundation increases the risks of transferring some inefficient and undesirable methods of work and reduces the worker's creativity (Yagoubi, 2004). Findings from our research suggest that system knowledge of both users and managers should be updated and continuously evaluated in order to ensure the effective deployment of the system and to keep users motivated to learn (Ke and Wei, 2008). Moreover, to be effective and successful, the training program should emphasize both the systems view-learning about the system's use and its different features- and the organization's view, learning is how the system and the user's action affects the other business processes (Rajagopalan et al., 2007).

Second, in order to cope with the high turnover rate of ERP experts and superusers, the constantly increasing knowledge of the system (from external parties such as vendors and consultants, workers' experiences with the system, etc.) the use of a (ERP) knowledge management system was considered as a highly effective tool to encourage learning and knowledge sharing and creation. ERP knowledge management system would include ERP knowledge repositories (manuals, databases, files, etc.) tracking problems, recording solutions and experiences and other system knowledge, that could be retrieved later to be shard and reused (Gunasekaran and Ngai, 2007). This imitative could also accelerate the integration and the adaptation of new recruits since they'll find the necessary documentation about the system as well documented experiences of other users. The knowledge management initiative would also comprise the formation communities of practice (Wenger and Snyder, 2000) including a cross-functional ERP steering committee, where top managers are also members of the committee as well as for instance formal and informal meetings between employees using the same module for instance in different plants. Such communities would enable the exchange and the sharing of knowledge and experiences as well as the brainstorming on improving the system and its deployment. Top management should however provide the appropriate conditions to effectively establish such communities. Freeing part of the employees' time, for instance, would be necessary to encourage their participation to improve their knowledge and to allow tem to better master the system.

Unlike previous research (e.g. Chang, 2004), our findings showed that a strategic relationship with the system vendor was not essential especially in the long term. Services such as updates and maintenance were possible to obtain from other vendors. Consultant effectiveness however remained an important factor for assimilation. Consultants, whose service could be also provided by the module vendor, need to display a high level of competence and expertise when it comes to installing and integrating a new module, lowering knowledge barriers by training the ERP team and users (. With their experience they can help the system improve its system assimilation and deployment and extend the system's value (Ifinedo, 2008). Institutional forces vary across companies depending on their industries and markets. Te strongest forces are the regulations, government forces, headquarters and external partners' pressures to properly assimilate the system in order to be ale to provide Integrated, detailed and real time information. The economic motivation remains however the main incentive to properly assimilate the system, deploy the maximum of its functionalities and to continuously optimize its value in order top fully benefit from its advantages.

7.2 How does the impact of the assimilation factors vary in the case of a developed *versus* a developing country?

Our second objective is to investigate if the impact of the assimilation factors varies between a developing and developed country context. Our findings showed several commonalities between both groups of companies in the two countries. Some issues and constraints were however more pronounced in the Tunisian context than the Canadian context.

First, there was a general resistance to the system in both the Canadian and the Tunisian companies, mainly those which were at a stabilization stage (Markus, 2000, Nah and Delgado, 2006) and which did not have a previous experience with an ERP system.

Moreover, human and technical problems experienced during the implementation stage and the concomitant high expenditures, the lack of an understanding of the nature of the stabilization stage and its issues, the lack of top management support and the fragile ERP human capital in most of the studied companies slowed down, and in one case halted, efforts of extending the system's value by adding new modules and rendered the ERP team work to stabilize the system and promote assimilation more difficult. Furthermore, the prevailing short term orientation among managers in both contexts had an obvious effect on the orientation of their ERP system and its level of assimilation. Indeed, the great majority of the interviewed managers focused more on cost reduction and on quick tangible results than on strategic outcomes. As a result, the system was mainly deployed for operational control and follow up, automation of routine administrative tasks and cross functional information exchange.

Problems experienced by the two Tunisian companies E and F such as the lack of integration of the organization's data, lack of aggregated data and information sharing between the different firm's units, the inappropriate formulation of information needs, and the inability to have a balanced scoreboard with the different key performance indicators of the firm, could be explained by the high power distance in Tunisian companies (Soyah and Magroun, 2004). Information is in fact considered as being not as a corporate asset but rather as a personal asset which should be selectively shared by other employees in the firm (Davison, 2002). Moreover, high power distance, high in-group loyalty and competitiveness between managers explain the discomfort and indirect rejection of the IT manager's instructions at Company F by peer managers. Competitiveness among managers and high power distance and the resulting fear of appearing incompetent to master the system further hamper system assimilation by preventing managers to benefit from the experience of other managers in one of the companies of the group that deploys the system (e.g. case of Company F). It is therefore a heavy responsibility on the IT manager to strive for building strong relationships based on collaboration, trust and mutual understanding to ensure their involvement and commitment to promote assimilation in the company (Nah and Delgado, 2006). Continuous education and communication with the organization's business community including top management to decrease conflicts between the technical and the business groups is deemed to be essential in order to improve the system understanding and to encourage its assimilation. Assigning a staff position to the IT function rather than a functional position was suggested by Tunisian respondents as a possible solution to avoid power conflicts (Law and Ngai, 2007).

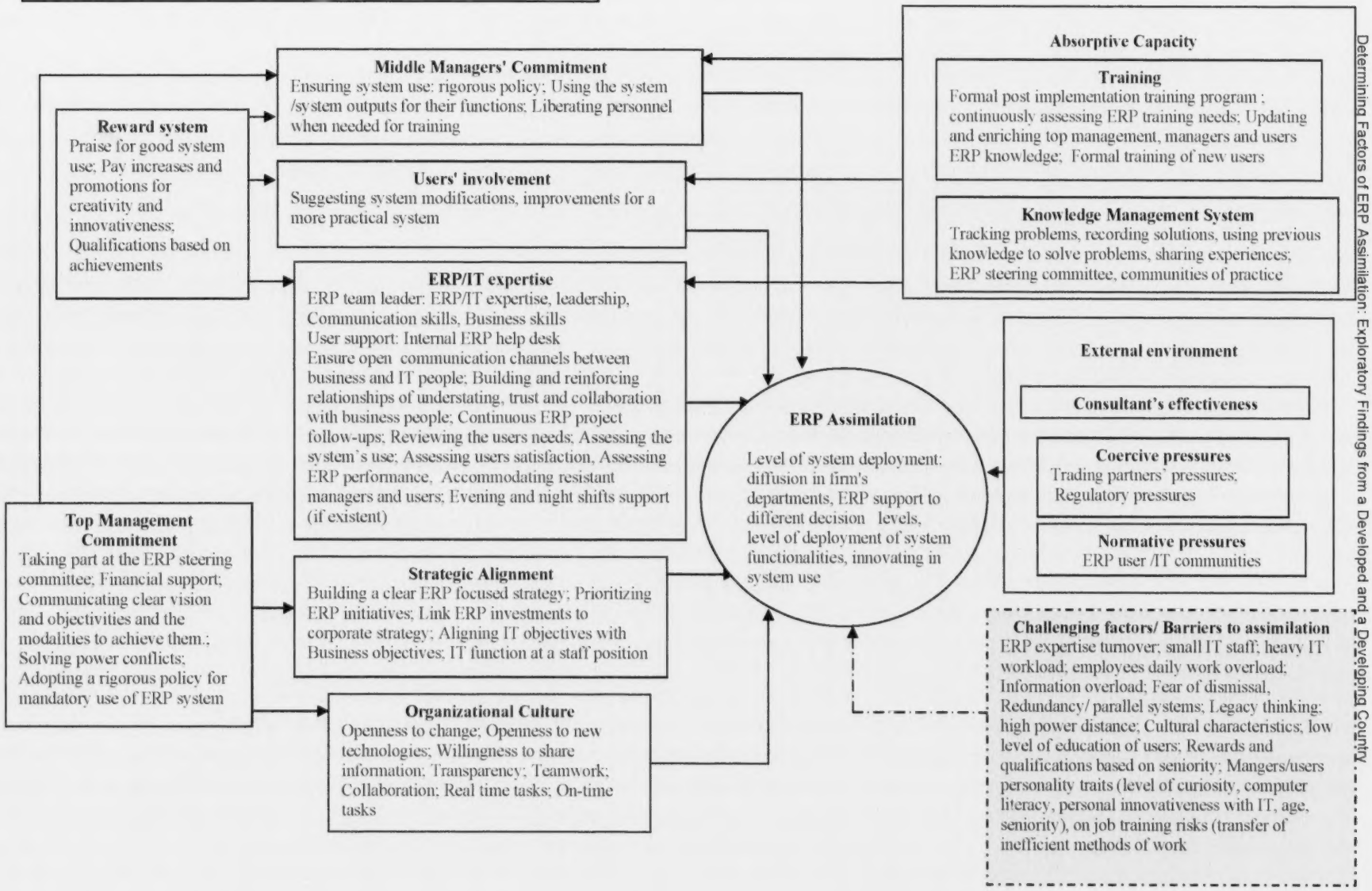
On the other hand company E, which is also a Tunisian company was in a much better position and exhibited a high level of system assimilation even though its system was still at a stabilization stage. This wide difference in assimilation level and the type of problems experienced at Company E compared to companies D and F could be attributed to several factors. First, Company E had a previous long successful experience with ERP systems. Second, this company is a subsidiary of a European multinational company that has been established in Tunisia since more than 80 years. Therefore, the values and the culture of the company such as information sharing, open communication, participation, encouraging learning and collaboration, and motivation were therefore deeply rooted and clearly manifested in its subsidiary. A similar organizational culture prevailed in the Canadian medium sized Company A and resulted also in a high level of assimilation.

Indeed, unlike the two other large companies, Company A was characterized by a "family ambiance" and by a management style that focused on participation, consultation and on seeking consensus. This management style significantly contributed in solving conflicts and problems that surfaced during the early post-implementation stage and helped improve the user's buy-in and commitment to the system (Nah et al., 2007, Martin and Huq, 2007, Ifinedo, 2007, Kei and Wei, 2008). Similarly, the fact this company's organizational culture promoted learning, risk taking and innovation encouraged a deeper deployment of the system functionalities and the extension of the system value by investing in new modules (Nah and Delagado, 2007, Kei and Wei, 2008).

One other issue that challenged effective assimilation in Tunisian companies is the tendency to encourage the use of seniority more than skills as an indicator of qualification which was found to discourage creativity and the establishment of individualized rewards (Yagoubi, 2004). Seniority presented also one of the major handicaps for ERP assimilation in the Canadian companies and resulted into resistance to the system's deployment and low assimilation levels. In a move to attenuate the level of resistance, one of the companies integrated some senior workers with the ERP project team as change agents. On one hand, they serve the ERP team by supplementing them with information about the business and on the other hand they act as motivators of the employees to encourage their acceptance of the system.

Figure 2 illustrates the refined module of our research based on our findings.

Figure 2 An integrative framework for ERP assimilation


Absorptive Capacity
Training
Formal post implementation training program ; continuously assessing ERP training needs; Updating and enriching top management, managers and users ERP knowledge; Formal training of new users
Knowledge Management System
Tracking problems, recording solutions, using previous knowledge to solve problems, sharing experiences; ERP steering committee, communities of practice
Middle Managers' Commitment
Ensuring system use: rigorous policy; Using the system /system outputs for their functions; Liberating personnel when needed for training
Reward system
Praise for good system use; Pay increases and promotions for creativity and innovativeness; Qualifications based on achievements
Users' involvement
Suggesting system modifications, improvements for a more practical system
ERP/IT expertise
ERP team leader: ERP/IT expertise, leadership, Communication skills, Business skills
User support: Internal ERP help desk
Ensure open communication channels between business and IT people; Building and reinforcing relationships of understating, trust and collaboration with business people; Continuous ERP project follow-ups; Reviewing the users needs; Assessing the system's use; Assessing users satisfaction, Assessing ERP performance, Accommodating resistant managers and users; Evening and night shifts support (if existent)
ERP Assimilation
Level of system deployment: diffusion in firm's departments, ERP support to different decision levels, level of deployment of system functionalities, innovating in system use
External environment
Consultant's effectiveness
Coercive pressures
Trading partners' pressures; Regulatory pressures
Normative pressures
ERP user /IT communities
Top Management Commitment
Taking part at the ERP steering committee; Financial support; Communicating clear vision and objectivities and the modalities to achieve them.; Solving power conflicts; Adopting a rigorous policy for mandatory use of ERP system
Strategic Alignment
Building a clear ERP focused strategy; Prioritizing ERP initiatives; Link ERP investments to corporate strategy; Aligning IT objectives with Business objectives; IT function at a staff position
Organizational Culture
Openness to change; Openness to new technologies; Willingness to share information; Transparency; Teamwork; Collaboration; Real time tasks; On-time tasks
Challenging factors/ Barriers to assimilation
ERP expertise turnover; small IT staff; heavy IT workload; employees daily work overload; Information overload; Fear of dismissal, Redundancy/ parallel systems; Legacy thinking; high power distance; Cultural characteristics; low level of education of users; Rewards and qualifications based on seniority; Mangers/users personality traits (level of curiosity, computer literacy, personal innovativeness with IT, age, seniority), on job training risks (transfer of inefficient methods of work

8 Conclusion

The present study adds to IT innovation diffusion literature by investigating the long neglected assimilation stage and ERP assimilation in particular. In addition, it fills the gap that still exists in research on ERP experience in developing countries. Our results show that there are numerous similarities in the success factors deemed to be critical to ERP assimilation in both Canada and Tunisia. Nevertheless, our findings reveal that there still exist a number of serious barriers that must overcome in both countries, and especially Tunisia. With the most challenging issue being the human factor, organizations should invest heavily in time and efforts to manage properly this resource. In developing cultures with high power distance, more efforts should be made to adjust the organization's culture in order to reap the maximum of the system's benefits. It is worth noting that with time, assimilation in terms of data integration, diffusion in the different organization units (departments, plants, warehouses, etc.) and deep deployment of the system features is achievable. However, promoting the system from supporting operational decisions to higher levels of decisions is not self-evident. On one hand, this is due to the technological complexities of the ERP systems when dealing with higher level of decisions and on the other hand to the managers' strong belief in human judgment and creativity.

There are some limitations to this study. First, this study is exploratory and was based on the perceptions of some respondents presenting their organizations. Therefore personal bias cannot be totally ruled out. Second, even though our case studies confirmed the influence of several contextual factors, our findings were based on companies at different stages in the post-implementation phase and using ERP systems from different vendors. The comparison of companies at approximately the same stage and/or using an ERP from the same vendor and/or having similar sizes would make the collected data more comparable. Finally, we do not consider the national culture in this research. Several studies inferred, however, that politics, language, economic conditions and several cultural dimensions affect ERP initiatives (Davison, 2002, Waarts and van Everdingen, 2005, Sheu et al., 2004). Our findings cannot be therefore generalized to companies in other countries.

A first area of future research is the extension of the data and the testing the relationships depicted in Figure 2. Our study was limited to comparing two countries, a developing and a developed country. The effects of the factors that were investigated in this research could be revised and validated by including a higher number of companies in both countries or by including more countries to validate our findings.

An additional interesting avenue of research would be to consider the impact of cultural dissimilarities and national conditions on ERP assimilation. Another research avenue is to closely investigate the ERP assimilation strategies in the subsidiaries of multinational groups. Learning about the strategies that facilitate the assimilation process in these companies could be useful for other companies in the same country to reduce the cultural misfits between the adopted system and the adopting organization. Another researcher area would be to investigate the long term effect of ERP systems on decision makers and the extent to which ERP systems provides the required information when making decisions.

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